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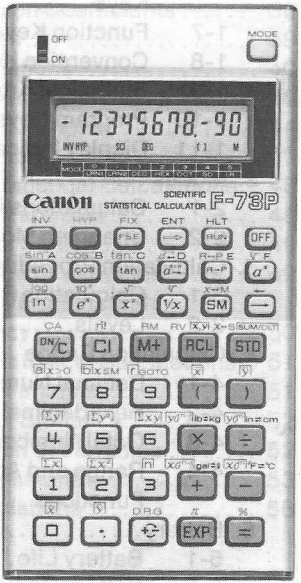
Canon

F-73P

SCIENTIFIC CALCULATOR



INSTRUCTIONS

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PUB.IE03-100M 0284B7 PRINTED IN JAPAN

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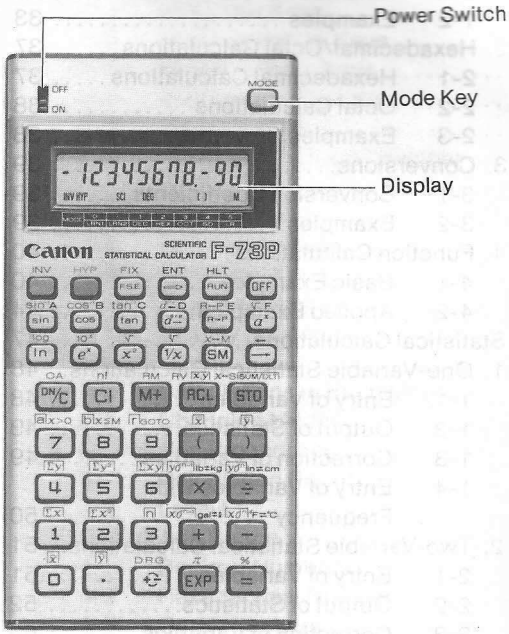
I. Before Using

1. Keys, Switch, and Display



1-1 Power Switch and Display ON,OFF and Clear Keys

Power Switch: When the power switch is turned off, all of the data in the calculator is cleared. So use the [ON/C] and [OFF] keys to turn the display on or off.

[OFF] Display OFF key: Turns the display off. When the display is turned off with this key, the contents of the independent memory, the storage memories, and the entered programs are retained.

[ON/C] Display ON/Clear Key: Clears the contents of the register except for the independent memory, the storage memories, and program memory, and resets the error lock (Clear).
Turns the display on (Display ON).

* Auto Power Off Function;
When the calculator is not used for about 7 minutes, the display is automatically turned off to save power. Use the [ON/C] key to turn the display on again.

[CA] Clear All Key: Clears the contents of the register and the storage memory and resets the error lock.
In the LRN1 or LRN2 mode, the program entered is cleared by depressing this key.

Register and Memory Cleared by Each Key Operation

Display Register
Calculation Register
Stack Memory
Storage Memory/ Statistical Calculation Memory
Independent Memory
Program Memory

OFF Key, %C Key and Auto Power Off Function → INV CA (ON/C)

1-2 Mode Selection Keys

INV Inverse Key: Specifies the second function of each key (written on the panel in green).

EX.

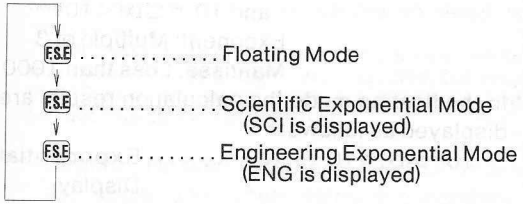
Expression	Operation	Display
$\sqrt[3]{30}=3.107232506$	30 INV $\sqrt[3]{}$ (1/x)	3.107232506

* When the INV key is depressed, INV is displayed. The function is actually set when the next key is depressed.
Depressing the INV key a second time resets the INV status.

MODE Calculation Mode Key: Specifies the calculation mode. Depressing the 1~5, 0 or . keys after this key sets the calculation mode as specified on the next page.

Key Operation	Mode	Display Indicador
MODE 1	Decimal Calculation Mode	
MODE 2	Hexadecimal Calculation Mode	HEX
MODE 3	Octal Calculation Mode	OCT
MODE 4	One-Variable Statistical Calculation Mode	SD
MODE 5	Two-Variable Statistical Calculation Mode	SD
MODE 0	Programming Mode 1	LRN
MODE .	Programming Mode 2	LRN

F.S.E Display Mode Key: Changes the display mode. The display mode rotates each time this key is depressed as follows.


F.S.E ..... Floating Mode
F.S.E ..... Scientific Exponential Mode (SCI is displayed)
F.S.E ..... Engineering Exponential Mode (ENG is displayed)

EX.

Key Operation	Display	Explanation
(F↔E)		(Floating Mode)
12345678 ×		Floating Mode
10 =	123456780.	
F↔E	1.2345678 08	Scientific Exponential Mode
F↔E	123.45678 06	Engineering Exponential Mode

- Display Range

  Scientific Exponential Mode ..... $x=0$ and $10^{-99} \leqq |x| < 10^{100}$

  Engineering Exponential Mode ..... $x=0$ and $10^{-99} \leqq |x| < 10^{100}$, Exponent: Multiple of 3, Mantissa: Less than 1000

* In the floating mode the calculation results are displayed as follows:

$10^{10} \leqq |x| < 10^{100}$ ..... Exponential Display

$10^{-99} \leqq |x| < 10^{-9}$ ..... Exponential Display

$x=0$ and $10^{-9} \leqq |x| < 10^{10}$ ..... Floating Display

FIX (F↔E) Decimal Point Selection Keys: Specifies the number of decimal digits in the mantissa of the decimal calculation results. Depressing the 0~7 or · keys after this key, specifies the number of decimal digits as follows:

INV FIX (F↔E) 0 ..... 0 decimal digits

INV FIX (F↔E) 1 ..... 1 decimal digit

⋮

INV FIX (F↔E) 7 ..... 7 decimal digits

INV FIX (F↔E) · ..... Resets the decimal specification

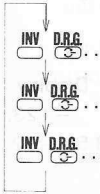
EX.

Key Operation	Display	Explanation
INV FIX (F↔E) 3	0.000	3 digits decimal
123456789 ×		
· 001 =	123456.789	
INV FIX (F↔E) 0	123457.*1	0 digit decimal
INV FIX (F↔E) 5	123456.7890*2	5 digits decimal

*1 The displayed value is rounded up within the specified range, but the actual calculation result is retained in the register.

*2 The number is displayed with left justification. In this case, 5 decimal digits are specified, but only the 10 most significant digits are displayed. The 5th decimal digit is not displayed.

D.R.G. (+/-) Degree, Radian, Gradient Key: Changes the angle unit when using trigonometric functions and inverse trigonometric functions. The angle unit rotates each time this key is depressed as follows.



INV D.R.G. (+/-) ..... Degree Mode (DEG is displayed)

INV D.R.G. (+/-) ..... Radian Mode (RAD is displayed)

INV D.R.G. (+/-) ..... Gradient Mode (GRAD is displayed)

- The relationship of units is:

$$200^{GRAD}=180°=\pi^{RAD}$$

1-3 Numeric Entry Keys

[0]~[9] **Numeric Keys:** Enter numbers.

[·] **Decimal Point Key:** Enters a decimal point.

EX.

Value	Operation	Display
12.3	[1][2][·][3]	12.3
0.123	[·][1][2][3]	0.123

- A maximum of 10 digits can be entered. Only the first 10 digits entered are registered and excess digits are ignored.

[EXP] **Exponential Key:** Used to enter exponents.

EX.

Value	Operation	Display
3.456×10^{43}	[3][·][4][5][6][EXP][4][3]	3.456 43
1×10^{98}	[EXP][9][8]	1.98

- A maximum of 2 digits can be entered for the exponent. When a number exceeding 2 digits is entered, only the last 2 digits are registered.

[+/-] **Sign Change Key:** Changes the sign of the displayed number.

EX.

Value	Operation	Display
−123	[1][2][3][+/-]	−123.
3.56×10^{-12}	[3][·][5][6][EXP][1][2][+/-]	3.56 −12

[⇨] **Shift Key:** Clears the last digit entered from the display and shifts other displayed numbers 1 digit to the right.

EX.

Value	Operation	Display
12345	[1][2][4] incorrect entry	124.
	[⇨]	12.
	[3][4][5]	12345.

[CI] **Clear Indicator Keys:** Clears an incorrect entry so that the correct number can be entered.

EX.

Calculation	Operation	Display
123×456=	123 [×]	123.
	456(incorrect entry)	459.
	[CI]	0.
	456[=]	56088

1-4 Basic Instruction Keys

[+][−][×][÷][=] **Basic Function Keys:** Used for basic arithmetic calculation. Depress the key corresponding to each operation.

[%] **Percent Key:** Used for percentage and increase ratio calculations.

( ) **Open, Close Parenthesis Keys:** These two keys are used only in pairs. The Open Parenthesis Key (must be depressed prior to the Close Parenthesis Key). When the Close Parenthesis Key is depressed, the calculation is performed.

RV (RCL) **Reverse Key:** Reverses the operand and the operator in multiplication and division sequences.

EX.

Expression	Operation	Display
$\frac{789}{123\times456}$	123 × 456 ÷	56088.
	789	789.
	INV RV (RCL)	56088.
=0.01406718	=	0.01406718

1-5 Memory Keys

This calculator has one independent memory and six storage memories.

M+ **Memory Plus Key:** Adds the displayed value to the contents of the independent memory.

RM (M+) **Read Memory Key:** Reads the contents of the independent memory and recalls them on the display.

SM **Store Memory Key:** Stores the displayed value in the independent memory. The current independent memory contents are deleted and the displayed value is stored in the independent memory.

x-M (SM) **Display/Independent Memory Change Key:** Stores the displayed value in the independent memory and displays the contents of the independent memory or vice versa.

Examples Using the Independent Memory

Operation	Display	Contents of the Independent Memory	Explanation
123	123.	0	
M+	123.	123	Stores 123
456 M+	456.	579	Adds 456
INV RM (M+)	579.	579	Read from memory
789 SM	789.	789	Stores 789
369	369.	789	
INV x-M (SM)	789.	369	Display↔ Memory
ON/C	0.	369	Clears display
SM	0.	0	Clears memory

STO **Store Key:** Stores the displayed value in the storage memories. The number of the storage memory must be specified immediately after depressing this key.

RCL Recall Memory Key: Recalls the contents of the storage memory.
The storage memory number must be specified immediately after depressing this key.

x⇔s STO Display/Storage Memory Change Key: Stores the displayed value in the storage memory and displays the contents of the specified storage memory or vice versa. The number of the storage memory must be specified immediately after depressing this key.

Examples Using the Storage Memories

Operation	Display	Contents of the Storage Memory 3	Explanation
123	123.	0	
STO 3	123.	123	Stores 123 in Storage Memory 3
2 ×	2.	123	
RCL 3	123.	123	Read from Storage Memory 3
=	246.	123	
STO 3	246.	246	Stores 246 in Storage Memory 3
456	456.	246	
INV x⇔s STO 3	246.	456	Display↔ Storage Memory

1-6 Hexadecimal/Octal Number Keys

0 ~ 9 A (sin) B (cos) C (tan) D (d'" ⇔ R→P) E F (d^x) **Hexadecimal Number Entry Keys**

EX.

Value	Operation	Display
		(HEX)
AB7C	A (sin) B (cos) 7 C (tan)	Ab7c

0 ~ 7 **Octal Number Entry Keys**

* The 8 and 9 keys are ignored in the OCT mode.

1-7 Function Keys

For the details of function calculations, refer to II-4 Function Calculations.

HYP **Hyperbolic**

sin **Sine Key**

cos **Cosine Key**

tan **Tangent Key**

ln **Natural Logarithm Key**

e^x **Exponential Function Key**

x^2 **Square Key**

1/x **Reciprocal Key**

d°'" ⇔ **Sexagesimal→ Decimal Conversion Key**

$\sin^{-1}$ **Arc Sine Key**

$\cos^{-1}$ **Arc Cosine Key**

$\tan^{-1}$ **Arc Tangent Key**

log **Common Logarithm Key**

10^x **Common Exponential Key**

$\sqrt{x^2}$ **Square Root Key**

$\sqrt[3]{1/x}$ **Cubic Root Key**

d°'" ⇔ **Decimal→ Sexagecimal Conversion Key**

R→P **Rectangular→ Polar Coordinates Conversion Key**

R←P **Polar→ Rectangular Coordinates Conversion Key**

a^x **Raising to Power Key**

$\sqrt[x]{a^x}$ **Multiple Root Key**

π EXP **Pi Key**

n! CI **Factorial Key**

1-8 Conversion Keys

→ ⇆ **Conversion Key:** Indicates the direction of the conversion, either metric to nonmetric or vice versa. Use the → key when converting nonmetric values to metric values. Use the INV ⇆ when converting metric values to nonmetric values. Enter the value to be converted, depress one of these keys, and then one of the conversion unit keys.

EX.

Value	Operation	Display
25 lb→?kg	25 → lb⇌kg (×)	11.33980925

lb⇌kg (×) **Pounds to/from Kilograms Key**

in⇌cm (÷) **Inches to/from Centimeters Key**

gal⇌l (+) **U.S Gallons to/from Liters Key**

°F⇌°C (−) **Fahrenheit to/from Centigrade Key**

1-9 Statistical Keys

SUM/DLT STO **Variable Entry (SUM)/ Variable Correction (DLT) Key**

x,y RCL **Variable (x, y) Entry Key (Two-variable statistical calculation)**

a 7 **Intercept (a) Key**

b 8 **Gradient (b) Key**

r 9 **Correlation Coefficient (r) Key**

$\hat{x}$ 0 **$\hat{x}$ Key**

$\hat{y}$. **$\hat{y}$ Key**

$\bar{x}$ RCL **$\bar{x}$ Key**

$\bar{y}$ 1 **$\bar{y}$ Key**

$\sum x$ 1 **Σx Key**

$\sum x^2$ 2 **Σx^2 Key**

n 3 **n Key**

$\sum y$ 4 **Σy Key**

$\sum y^2$ 5 **Σy^2 Key**

$\sum xy$ 6 **Σxy Key**

$x\sigma^{n-1}$ + **$x\sigma^{n-1}$ Key**

$x\sigma^n$ − **$x\sigma^n$ Key**

$y\sigma^{n-1}$ × **$y\sigma^{n-1}$ Key**

$y\sigma^n$ ÷ **$y\sigma^n$ Key**

1-10 Program Keys

For details of programmed calculations, refer to IV Programmed Calculations.

Entry Key: Used for entry of the program instruction "ENT" in the LRN1 and LRN2 modes.

Halt Key: Used for entry of the program instruction "HLT" in the LRN1 and LRN2 modes.

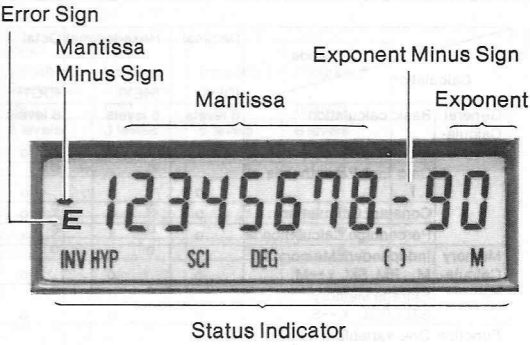
$x > 0$ Key: Used for entry of the program instruction "$x > 0$" in the LRN1 and LRN2 modes.

$x \leqq n$ Key: Used for entry of the program instruction "$x \leqq M$" in the LRN1 and LRN2 modes.

GOTO Key: Used for entry of the program instruction "GOTO" in the LRN1 and LRN2 modes.

Program Run Key: Executes the program. When the RUN key is depressed in the DEC mode, the program entered in the LRN1 mode is executed. To execute the program entered in the LRN2 mode, depress the INV and RUN keys.

1-11 Display Indicators



Status Indicators

INV; Inverse
HYP; Hyperbolic
HEX; Hexadecimal Mode
OCT; Octal Mode
SCI; Scientific Exponential Mode
ENG; Engineering Exponential Mode
DEG; Degree Mode
RAD; Radian Mode
GRAD; Gradient Mode
SD; Statistic Mode
[ ]; Calculation in Parentheses
LRN; LRN1 or LRN2 Mode
HLT; HLT State
M; Independent Memory in Use

2. Modes

2-1 Calculations in Each Mode

Calculation \ Mode		Decimal (DEC)	Hexadecimal (HEX)	Octal (OCT)	One-Variable Statistical (SD)	Two-Variable Statistical (LR)	Program 1 (LRN1)	Program 2 (LRN2)
General Calculation	Basic calculation	6 levels	6 levels	6 levels	6 levels	3 levels	6 levels	6 levels
	+, −, ×, ÷	o	o	o	o	o	o	o
	Calc. incl. Parentheses (,)	o	o	o	o	o	o	o
	Constant Calculation	o	o	o	o	o	o	o
	Percentage Calculation %	o	x	x	o	o	o	o
Memory Calculation	Independent Memory M+, RM, SM, $x \leftrightarrow M$	o	o	o	o	o	o	o
	Storage Memory STO, RCL, $X \leftrightarrow S$	o	o	o	x	x	o	o
Function Calculation	One-variable function calc.	o	x	x	o	o	o	o
	Two-variable function R↔P, R↔P	o	x	x	x	x	o	o
	a^X, $\sqrt[X]{}$	o	x	x	o	o	o	o
Conversion	in⇄cm, lb⇄kg gal⇄l, °F⇄°C	o	x	x	o	o	o	o
Statistical Calculation	One-variable	x	x	x	o	o	o	o
	Two-variable	x	x	x	o	o	x	x
	Regression Calc.	x	x	x	x	o	x	x
Programmed Calculation	Program Entry	x	x	x	x	o	x	x
	Program Execution	o	x	x	x	x	x	x
Entry	0~7	o	o	o	o	o	o	o
	8, 9	o	o	x	o	o	o	o
	A~F	x	o	x	x	x	x	x
	(·), (EXP) Key	o	x	x	o	o	o	o
	(+/−) Key	o	o	o	o	o	o	o
	(→) Key	o	o	o	o	o	x	x
Clear	(%C), (CI) Key	o	o	o	o	o	-	-
Display	F. S. E	o	x	x	o	o	x	x
Change	FIX	o	x	x	o	o	x	x

2-2 Changing Modes

The mode can be changed any time except when the calculator is OFF or locked because of an error. When the mode is changed, the value is changed, the value is displayed, and the calculation procedure changes as shown in the following table.

Before / After	DEC	HEX	OCT	SD or LR	LRN1 or LRN2
DEC		Displayed Value: **Converted** Calc. Procedure: **Retained**	Displayed Value: **Converted** Calc. Procedure: **Retained**	Displayed Value: **Retained** Calc. Procedure: **Cleared**	Displayed Value: **Retained** Calc. Procedure: **Cleared**
HEX	Displayed Value: **Converted** Calc. Procedure: **Retained**		Displayed Value: **Converted** Calc. Procedure: **Retained**	Displayed Value: **Converted** Calc. Procedure: **Cleared**	Displayed Value: **Converted** Calc. Procedure: **Cleared**
OCT	Displayed Value: **Converted** Calc. Procedure: **Retained**	Displayed Value: **Converted** Calc. Procedure: **Retained**		Displayed Value: **Converted** Calc. Procedure: **Cleared**	Displayed Value: **Converted** Calc. Procedure: **Cleared**
SD or LR	Displayed Value: **Retained** Calc. Procedure: **Cleared**	Displayed Value: **Converted to decimal** Calc. Procedure: **Cleared**	Displayed Value: **Converted to decimal** Calc. Procedure: **Cleared**		Displayed Value: **Retained** Calc. Procedure: **Cleared**
LRN1 or LRN2	Displayed Value: **Retained** Calc. Procedure: **Cleared**	Displayed Value: **Converted to decimal** Calc. Procedure: **Cleared**	Displayed Value: **Converted to decimal** Calc. Procedure: **Cleared**	Displayed Value: **Retained** Calc. Procedure: **Cleared**	

In addition, when the mode is changed during calculation:

- Display mode, decimal point specification, and angle unit specification are retained.
- The memory contents are retained.
- The programs are retained.

* The mode change is carried out even if an error is made when changing the mode.

3. Calculation Procedure

3-1 Calculation Priority

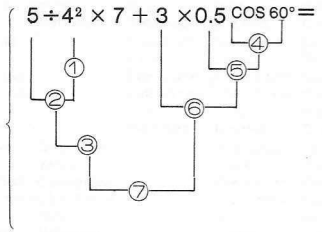
The calculation procedure priority is automatically determined by the calculator. This means that algebraic expressions can be entered just as they are written. The calculation priority is as follows:

High Priority ↑
- One-variable function
- Calculation in ( )
- a^x, $\sqrt[x]{}$
- ×, ÷
- +, −

EX.

$5 \div 4^2 \times 7 + 3 \times 0.5 \cos 60° =$

Calculation Order



Mode: DEG

Operation		Display	
5 ÷	(	5.)	
4 x^2	(	16.)	·····①
×	(	0.3125)	·····②
7 +	(	2.1875)	·····③
3 ×	(	3.)	
.5 a^x	(	0.5)	
60 cos	(	0.5)	·····④
=	(4.308820344)		·····⑦

3-2 Levels

During actual calculation, numbers and calculation instructions not being processed which are a low priority, are stored in the stack memory. This stack memory can store up to 6 levels of calculations.

EX.

$1 + 2 \times (\text{SIN } 30° + 6) =$

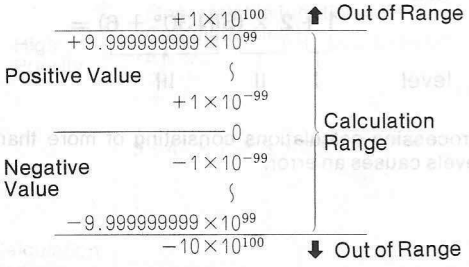
level I II III

* Processing calculations consisting of more than 6 levels causes an error.

4. Calculation Range

4-1 Decimal Numbers

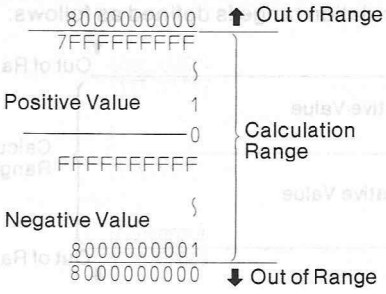
A maximum of 10 digits in the mantissa, or 8 digits in the mantissa with 2 digits in the exponent, can be entered or displayed. A negative value is indicated by adding a minus (-) sign. The calculation range is defined as follows:



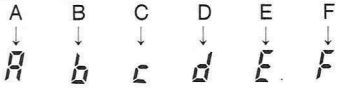
* If the result of a calculation is out of the above range, an error occurs.
* For the calculation range during function calculation, refer to 4-4, Range and Accuracy of Functions.

4-2 Hexadecimal Numbers

A maximum of 10 hexadecimal digits can be entered and displayed. Negative hexadecimal values are expressed by their two's compliment. The calculation range is defined as follows:



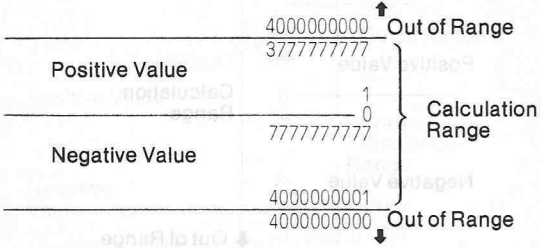
* If the result of a calculation is out of the above range an error occurs.
- The hexadecimal numbers A to F are displayed as follows:



4-3 Octal Numbers

A maximum of 10 octal digits can be entered and displayed. Negative octal values are expressed by their two's compliment. The calculation range is defined as follows:

The calculation range is defined as follows:



* If the result of a calculation is out of the above range an error occurs.

4-4 Range and Accuracy of Functions

Functions		Calculation Range	Accuracy
$\sin x$	DEG	$0, 4.5\times10^{-97} \leq \lvert x \rvert \leq 4.499999999\times10^{9}$	10 digits ± 0
	RAD	$0, 7.853981634\times10^{-99} \leq \lvert x \rvert \leq 7853981633$	$0 \leq \lvert x \rvert < \pi$, 10 digits ± 5 $\pi \leq \lvert x \rvert < 2\pi$, 9 digits ± 1
	GRAD	$0.5\times10^{-97} \leq \lvert x \rvert \leq 4.999999999\times10^{9}$	10 digits ± 0
$\cos x$	DEG	$0 \leq \lvert x \rvert \leq 4.500000089\times10^{9}$	10 digits ± 1
	RAD	$0 \leq \lvert x \rvert \leq 78539817.9$	$0 \leq \lvert x \rvert < \pi$, 10 digits ± 5 $\pi \leq \lvert x \rvert < 2\pi$, 9 digits ± 1
	GRAD	$0 \leq \lvert x \rvert \leq 5.000000099\times10^{9}$	10 digits ± 1
$\tan x$	DEG	$\sin x$ Same as (Except $\lvert X \rvert = 90° + 180° \times n$)	10 digits ± 1
	RAD	$\sin x$ Same as (Except $\lvert x \rvert = 90° + 180° \times n$)	$0 \leq \lvert x \rvert < \pi$, 10 digits ± 5 $\pi \leq \lvert x \rvert < 2\pi$, 9 digits ± 1
	GRAD	$\sin x$ Same as (Except $\lvert x \rvert = 90° + 180° \times n$)	10 digits ± 1
$\sin^{-1} x$	DEG	$0, 1.570796327\times10^{-99} \leq \lvert x \rvert \leq 1$	10 digits ± 1
	RAD	$0 \leq \lvert x \rvert \leq 1$	10 digits ± 1
	GRAD	$0, 1.570796327\times10^{-99} \leq \lvert X \rvert \leq 1$	10 digits ± 1
$\cos^{-1} x$	DEG	$0 \leq \lvert x \rvert \leq 1$	10 digits ± 1
	RAD	$0 \leq \lvert x \rvert \leq 1$	10 digits ± 1
	GRAD	$0 \leq \lvert X \rvert \leq 1$	10 digits ± 1
$\tan^{-1} x$	DEG	$0, 1.570796327\times10^{-99} \leq \lvert x \rvert \leq 9.999999999\times10^{99}$	10 digits ± 1
	RAD	$0, 1.570796327\times10^{-99} \leq \lvert x \rvert \leq 9.999999999\times10^{99}$	10 digits ± 1
	GRAD	$0, 1.570796327\times10^{-99} \leq \lvert x \rvert \leq 9.999999999\times10^{99}$	10 digits ± 1
$\ln x$		$0 < x$	10 digits ± 1
$\log x$		$0 < x$	10 digits ± 1
$\sqrt[3]{x}$		$0 \leq \lvert x \rvert \leq 9.999999999\times10^{99}$	$0 \leq \lvert x \rvert < 1\times10^{30}$, 10 digits ± 1 $1\times10^{30} < \lvert x \rvert \leq 9.999999999\times10^{99}$

Functions	Calculation Range	Accuracy
e^x	$-227.9559242 \leq x \leq 230.2585092$	10 digits ± 1
10^x	$-9.9 \leq x \leq 99.99999999$	10 digits ± 1
$1/x$	$1\times10^{-99} \leq \lvert x \rvert \leq 1\times10^{99}$	10 digits ± 0
x^2	$0,1\times10^{-49} \leq \lvert x \rvert \leq 9.999999999\times10^{49}$	10 digits ± 0
$\sqrt{x}$	$0 \leq x \leq 9.999999999\times10^{99}$	10 digits ± 0
n !	$0 \leq n \leq 69$ integer	10 digits ± 1
$a^{\prime\prime\prime}\rightarrow x$	$0 \leq \lvert x \rvert \leq 9.999999999\times10^{9}$	10 digits ± 1
$x\leftarrow a^{\prime\prime\prime}$	$0,2.777777778\times10^{-99} \leq \lvert x \rvert \leq 9.999999999\times10^{9}$	10 digits ± 1
a^x	$0<a$ $-227.9559242 \leq x\cdot\ln a \leq 230.2585092$	9 digits ± 1
$x\sqrt{a}$	$0<a$ $-227.9559242 \leq (\ln a)/x \leq 230.258592$	9 digits ± 1
R→P $(x,y\rightarrow r\theta)$	$0.1\times10^{-99} \leq x^2+y^2 \leq 9.999999999\times10^{99}$ (y/x must be in the range of sin x)	r ; 10 digits ± 0 θ ; 10 digits ± 1
P→R $(r\theta\rightarrow x,y)$	$0 \leq \gamma$ (θ must be in the range of sin x)	x is accurate as sin x
sinh x	$0 \leq \lvert X \rvert \leq 230.2585092$	10 digits ± 0
cosh x	$0 \leq \lvert x \rvert \leq 230.2585092$	10 digits ± 1
tanh x	$0 \leq \lvert x \rvert \leq 9.999999999\times10^{99}$	$0.01 < \lvert x \rvert < 0.1$ is 10 digits ±4, others are 10 digits ±1
$\sinh^{-1}x$	$0 \leq \lvert x \rvert \leq 4.999999999\times10^{99}$	10 digits ± 1
$\cosh^{-1}x$	$0 \leq \lvert x \rvert \leq 4.999999999\times10^{99}$	$1.00011 < x$ 10 digits ±1 $1.0000011 < x \leq 1.00011$ 9 digits ±1 $1.00000011 < x \leq 1.0000011$ 8 digits ±1 $1.00000001 < x \leq 1.00000011$ 7 digits ±1
$\tanh^{-1}x$	$0 \leq \lvert x \rvert \leq 9.999999999\times10^{-1}$	10 digits ± 0

* The accuracy in the RAD mode increases close to the zero and divergence points.

5. Batteries

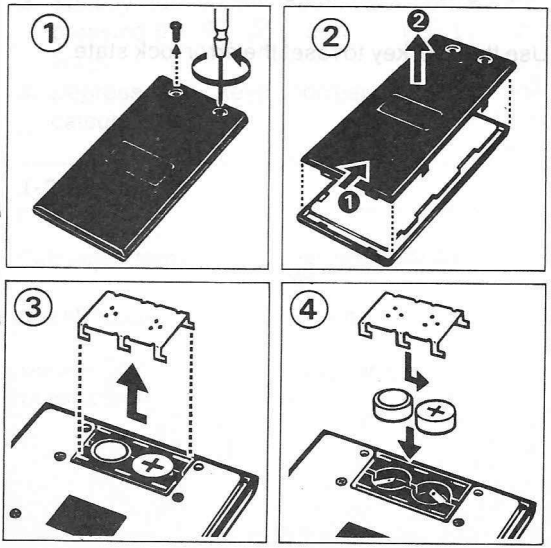
5-1 Battery Life

Two silver oxide batteries (Type: G13): About 4,000 hours of operation.
Two alkaline batteries (Type: A76 or LR44): About 1,500 hours of operation.

When the display dims, change both batteries at the same time.

* Keep batteries out of childrens' reach. If batteries are swallowed, contact a doctor immediately.

5-2 Battery Replacement



6. Errors

An error occurs, "E 0." is displayed, and the calculator locks in the following cases:

1. When the calculation result or the memory contents exceed the calculation range.
2. When $a \div 0$ is performed.
3. When the value entered in function or statistical calculations exceeds the input limitation.
4. When the number of calculation nesting levels exceeds 6.
5. When the total number of program steps entered exceeds 45.
6. When an undefined step is specified in the program and the program is executed.

Use the [%/c] key to reset the error lock state.

II. Decimal Calculations, Hexadecimal/Octal Calculations, Conversions, and Function Calculations

1. Decimal Calculations

1-1 Calculation Procedure

1. Depress the [MODE] and [1] keys to specify the DEC mode.
2. Select the display mode by depressing the [F⇔E] key.
3. Specify the decimal point position by depressing the [INV], [FIX (F⇔E)], and [·] ([□][1] ~ [7]) keys.
4. Depress the keys corresponding to the calculation.

1-2 Examples

Calculation Mode	:Decimal Mode (DEC) [MODE][1]
Display Mode	:Floating
Decimal Point Specification	:Reset [INV][FIX (F⇔E)][·]

Expressions	Operation
Mixed Calculation	
$(3+5)\times 7=56$	(3+5)×7= (56.)
$-6\times 9\div 3+2=-16$	6+/-×9÷3+2= (−16.)
Repeat Calculation	
$4+4+4+4=16$	4+== (16.)
$10-2-2-2=4$	10−2== (4.)
Calculation with Parentheses	
$((4-3.6+5)\times 0.8-6)\times 4.2=-7.056$	((4−3.6+5)×0.8− 6)×4.2= (−7.056)
Exponential Calculation	
$(321\times 10^{-14})\times(65\times 10^{28})=2.0865\times 10^{18}$	321EXP14+/-×65EXP28= (2.0865 18)
Constant Addition	
$2+3=5$	2+3= (5.)
$4+3=7$	4 = (7.)
Constant Subtraction	
$1-2=-1$	1−2= (−1.)
$2-2=0$	2 = (0.)
Constant Multiplication	
$3\times 2=6$	3×2= (6.)
$4\times 2=8$	4 = (8.)
Constant Division	
$6\div 3=2$	6÷3= (2.)
$9\div 3=3$	9 = (3.)

In constant addition, the addend
In constant subtraction, the subtrahend
In constant multiplication, the multiplier
In constant division, the divisor
} is automatically specified as the constant.

Percentage Calculation 17% of 200 $\frac{200\times 17}{100}=34$	200×17 INV % (34.)
Percentage Calculation 456 is x % of 789 $\frac{456}{789}\times 100=57.79467681\%$	456÷789 INV % (57.79467681)
Increase Ratio If the sales amount for one month was 120 million and the next month increased to 150 million, what was the percentage of increase from one month to the next? Increase Ratio $=\frac{150-120}{120}\times 100=25\%$	150−120 INV % (25.)

Constant Percentage Calculation

1200×12%=144	1200 × 12 INV % =	(144.)
1500×12%=180	1500 INV % =	(180.)
1700×12%=204	1700 INV % =	(204.)
$\frac{765}{987}$=77.50759878%	765 ÷ 987 INV % =	(77.50759878)
$\frac{654}{987}$=66.26139818%	654 INV % =	(66.26139818)
$\frac{543}{987}$=55.01519757%	543 INV % =	(55.01519757)

Calculation Using the Independent Memory (I)

20×30= 600	20 × 30 = M+	(600.)
40×50= 2000	40 × 50 = M+	(2000.)
15×20= 300	15 × 20 = M+	(300.)
2900	INV RM (M+)	(2900.)
−)125×40= −5000	125 × 40 = ÷ M+	
−2100		(−5000.)
	INV RM (M+)	(−2100.)

Calculation Using the Independent Memory (II) (Composition Ratio Calculation)

Composition Ratio (%)

A 125	(25)	
B 185	(37)	
C 190	(38)	
(500)	(100)	

125 + 185 + 190 = SM	(500.)
125 ÷ INV (M+) INV % = SM	(25.)
185 INV % M+	(37.)
190 INV % M+	(38.)
INV RM (M+)	(100.)

2. Hexadecimal/Octal Calculations

Basic calculations, calculations with parentheses, constant calculations, and calculations using the independent memory are performed with the same operation as that for decimal calculation. Percentage calculation cannot be performed in the hexadecimal/octal modes. The decimal portion of the calculation result is rounded off in the hexadecimal/octal mode.

2-1 Hexadecimal Calculations

Calculation Mode: Hexadecimal (HEX) MODE 2

Expression	Operation (Display)
Addition and Subtraction	
AAA+BB+C=B71	A A A + B B + C = (b71.)
DEF−EFE= FFFFFFFEF1	D E F − E F E = (FFFFFFFEF1.)
Multiplication and Division	
FEDC×A9= A83F3C	F E D C × A 9 = (A83F3C.)
CA11÷DF≒E7	C A 11 ÷ D F = (E 7.)
Mixed Calculation	
(AB+C)×D÷F≒9E	(A B + C) × D ÷ F = (9E.)

2-2 Octal Calculation

Calculation Mode: Octal (OCT) MODE 3

Expression	Operation (Result)
Addition and Subtraction	
654 + 321 = 1175	654 + 321 = (1175.)
741 − 357 = 362	741 − 357 = (362.)
Multiplication and Division	
56 × 23 = 1552	56 × 23 = (1552.)
621 ÷ 12 = 50	621 ÷ 12 = (50.)
Mixed Calculation	
52 + 63 × 14 = 1216	52 + 63 × 14 = (1216.)

2-3 Hexadecimal/Octal Mixed Calculations

Expression	Operation (Result)
$789_{10} + ABC_{16} - 456_8$	MODE 1 789 + MODE 2 ABC −
$= 6243_8$	MODE 3 456 = (6243.)
$= 3235_{10}$	MODE 1 (3235.)
$= CA3_{16}$	MODE 2 (CA3.)

In the example above, 16 indicates the hexadecimal number, 10 indicates the decimal number, and 8 indicates the octal number.

3. Conversion

3-1 Conversion Coefficient

Conversion is performed using the following expressions.

	→	←
lb⇄kg	$\times 4.5359237 \times 10^{-1}$	$\div 4.5359237 \times 10^{-1}$
in⇄cm	$\div 3.937007874 \times 10^{-1}$	$\times 3.937007874 \times 10^{-1}$
gal⇄l	$\times 3.785411784$	$\div 3.785411784$
F°⇄C	$\frac{°F-32}{1.8}$	$1.8 \times 1°C + 32$

3-2 Examples

Calculation Mode: Decimal (DEC) MODE 1

4 inches → 10.16cm	4 → in⇄cm (10.16)
45.6kg → 100.5307916 lb	45.6 INV ← lb⇄kg (100.5307916)
567gallons → 2146.328482ℓ	567 → gal⇄ℓ (2146.328482)
18.5°C → 65.3°F	18.5 INV ← °F⇄°C (65.3)

4. Function Calculations

4-1 Basic Examples

Expression	Angle Specification	Operation (Result)
Trigonometric Functions		
$\sin 53° = 0.79863551$	(DEG) 53 sin	(0.79863551)
$\tan 65^{GRAD} = 1.631851687$	(GRAD) 65 tan	(1.631851687)
$\sin \frac{\pi}{3}^{RAD} = 0.866025403$	(RAD) INV π (EXP) ÷ 3 = sin	(0.866025403)
Inverse Trigonometric Functions		
$\cos^{-1} 0.8 = 36.86989765°$	(DEG) • 8 INV cos⁻¹ (cos)	(36.86989765)
Hyperbolic Functions		
$\cosh 34 = 2.9173087 \times 10^{14}$	34 HYP cos	(2.9173087 14)
$\tanh 1.23 = 0.842579325$	1.23 HYP tan	(0.842579325)
Inverse Hyperbolic Functions		
$\sinh^{-1} 1.5 \times 10^{25} = 58.66323961$	1.5 EXP 25 INV HYP sin	(58.66323961)
Logarithmic Functions		
$\log 123 = 2.089905111$	123 INV log (ln)	(2.089905111)
$\ln 123 = 4.812184355$	123 ln	(4.812184355)

Exponential Functions	
$e^{22} = 3584912846$	22 e^x (3584912846.)
$10^{2.3} = 199.5262315$	2.3 INV 10^x (e^x) (199.5262315)
Multiple Root	
$\sqrt[5.3]{100} = 2.384286779$	100 INV $\sqrt[x]{}$ (a^x) 5.3 = (2.384286779)
Extraction of Cubic Root	
$\sqrt[3]{123} = 4.973189833$	123 INV $\sqrt[3]{}$ ($\sqrt[x]{}$) (4.973189833)
Reciprocal Calculation	
$\frac{1}{2 \times 3 + 4} = 0.1$	2 × 3 + 4 = 1/x (0.1)
Power Calculation	
$5.43^3 = 160.103007$	5.43 a^x 3 = (160.103007)
$2^{3.4} = 10.55606329$	2 a^x 3.4 = (10.55606329)
Extraction of Square Root	
$\sqrt{(5+6) \times 7} = 8.774964387$	(5 + 6) × 7 = INV $\sqrt{}$ (x^2) (8.774964387)
Square Calculation	
$1.25^2 = 1.5625$	1.25 x^2 (1.5625)
Factorial Calculation	
$(4 \times 2 - 3)! = 120$	(4 × 2 − 3) INV n! (Cl) (120.)
Permutation	
${}_nP_r = \frac{n!}{(n-r)!}$	5 INV n! (Cl) ÷ (5 − 3)
${}_5P_3 = \frac{5!}{(5-3)!} = 60$	INV n! (Cl) = (60.)

Combination

$${}_nC_r=\frac{n!}{r!(n-r)!}$$

$${}_5C_3=\frac{5!}{3!\times(5-3)!}=10$$

5 INV n! (÷) ( ) 3 INV n! (×)
( ) 5 (−) 3 ( ) INV n! ( ) (=)

(10.)

Continuous Calculation

$3\sin^2 65°=2.464181415$

(DEG) 3 (×) 65 sin x^2 (=)

(2.464181415)

$3+\sqrt{3}=4.732050808$

3 (+) INV $\sqrt{\ }$ (=) (4.732050808)

Degree→ Radian Conversion

$60°=1.047197551^{\mathrm{RAD}}$

(DEG) 60 sin INV D.R.G. INV $\sin^{-1}$

(1.047197551)

Cosecant

$$\mathrm{cosec}\,x=\frac{1}{\sin x}$$

$\mathrm{cosec}\,45°=1.414213562$

(DEG) 45 sin 1/x (1.414213562)

Logarithmic Mean

$$\overline{L}=\frac{4-8}{\ln 4-\ln 8}=5.770780163$$

(4 − 8) ÷ (4 ln − 8 ln
) (=)

(5.770780163)

Geometric Mean

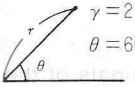
$$\overline{G}=\sqrt[4]{1.23\times1.48\times1.96\times2.2}=1.673830182$$

1.23 (×) 1.48 (×) 1.96 (×) 2.2 (=)
INV $\sqrt[x]{\ }$ 4 (=)

(1.673830187)

Polar Conversion

$(1,\sqrt{3})$.



$r=2$

$\theta=60°$

(DEG) 1 INV RV (RCL) 3 INV $\sqrt{\ }$ P→R

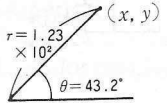
(2.)

INV RV (RCL) (60.)

Rectangular Conversion

$x=89.66314117$

$y=84.19929403$

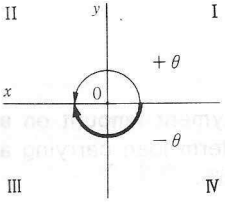


(DEG) 1.23 EXP 2 INV RV (RCL) 43.2 INV R←P

(89.66314117)

INV RV (RCL) (84.19929403)

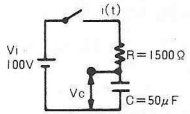
* In polar conversion θ in the third and fourth quadrant are as shown in the diagram.



Degrees-Minutes-Seconds→ Decimal Degrees	
123°45'06"→123.7516666°	123.4506 d→ (123.7516666)
Decimal Degrees→ Degrees-Minutes-Seconds	
2.3456°→2°20'44.16"	2.3456 INV d→ (2.204416)

4-2 Applied Examples

[Electricity]
Electric Circuits
Obtain the voltage VC at both terminals of the condenser at $t = 56$msec.



$$Vc = Vi(1 - e^{\frac{t}{RC}})$$
$$= 100 \times (1 - e^{\frac{56\times10^{-3}}{1500\times50\times10^{-6}}}) = 52.60562649$$

100 × (1 − (1500 × 50 EXP 6 +/− ÷ 56 EXP 3 +/−) 1/x +/− e^x) = (52.60562649)

[Financial Calculations]
Loan Repayment
Determine the monthly payment amount on a one million yen, ten-year term loan carrying a monthly interest rate of 0.75%.

PMT = Amount of repayment
PV = Amount of loan
i = Monthly interest
n = Number of years

$$PMT = PV\frac{i}{1-\frac{1}{(1+i)^n}} = 1000000 \times \frac{0.0075}{1-\frac{1}{(1+0.0075)^{10\times12}}}$$

$$= 12667.57738$$

(1 + .0075) a^x (10 × 12) = 1/x +/− + 1 = 1/x × .0075 × 1000000 = (12667.57738)

[Algebra]
The Root of a Quadratic Equation
(Only for problems having a real root.)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-9 \pm \sqrt{9^2 - 4\times4\times2}}{2\times4}$$

$$x = \begin{cases} -0.25 \\ -2 \end{cases}$$

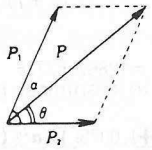
9 x^2 − 4 × 4 × 2 = SM (49.)

(9 +/− + INV RM(M+) INV $\sqrt{x^2}$) ÷ 2 ÷ 4 = (−0.25)

(9 +/− − INV RM(M+) INV $\sqrt{x^2}$) ÷ 2 ÷ 4 = (−2.)

[Physics]
Synthesis of Two Vectors

$P_1 = 30$
$P_2 = 15$
$\alpha = 60°$



$$P = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos\alpha}$$
$$= \sqrt{30^2 + 15^2 + 2 \times 30 \times 15 \times \cos 60°}$$
$$= 39.68626967$$

$$\theta = \tan^{-1}\left(\frac{P_1\sin\alpha}{P_1\cos\alpha + P_2}\right) = \tan^{-1}\left(\frac{30\sin 60°}{30\cos 60° + 15}\right)$$
$$= 40.89339465°$$

(DEG)

30 [x²] [+] 15 [x²] [+] 2 [×] 30 [×] 15 [×] 60 [cos] [=] [INV] [√‾]
(39.68626967)

30 [×] 60 [sin] [÷] [(] 30 [×] 60 [cos] [+] 15 [)] [=] [INV] [tan]
(40.89339465)

III. Statistical Calculations

One-variable and two-variable statistical calculations can be performed on this calculator.

The calculation result can be entered as the variable. Enter it after the calculation is completed by depressing the [)] or [=] key.

Two-variable function calculation (R→P, R←P) and calculation using the storage memory cannot be performed in the statistical mode.

The range of variable entry is:
$0 \leqq n \leqq 9999999999$
$0 \leqq |x| \leqq 50^{50}$, $0 \leqq |y| \leqq 5^{50}$

Since the storage memories are used to store the statistical calculation results, clear the storage memory by depressing the [INV] and [CA] keys before starting a statistical calculation.

1. One-Variable Statistical Calculations

(Ex. 1) Calculate the sum (Σx), square sum (Σx^2), number (n), mean value ($\bar{x}$), standard deviation sample (σ^{n-1}), and standard deviation population parameter (σ^n) from the following variables (x).

n	1	2	3	4	5
x	2.00	3.50	3.21	3.61	2.48

1-1 Entry of Variables

Operation	Display	Explanations
MODE 1	0.	Specifies the one-variable statistical mode
INV CA (ON/C)	0.	Clears the storage memory
INV FIX (F.S.E) 4	0.0000	Specifies decimal point selection at 4 digits
2 SUM (STO)	1.0000	Entry of variables * Variable numbers are displayed.
3.5 SUM (STO)	2.0000	
3.21 SUM (STO)	3.0000	
3.61 SUM (STO)	4.0000	
2.98 SUM (STO)	5.0000	

1-2 Output of Statistics

INV Σx (1)	15.3000	Σx
INV Σx^2 (2)	48.4666	Σx^2
INV n (3)	5.0000	n
INV $\bar{x}$ (0)	3.0600	$\bar{x}$
INV $x\sigma^n$ (−)	0.5742	$x\sigma^n$
INV $x\sigma^{n-1}$ (+)	0.6420	$x\sigma^{n-1}$

* Additional variables can be entered even after the statistics are output.

1-3 Correction of Variables

Entered variables can be corrected with the CI key before the SUM (STO) key is depressed.

(Ex.) 1 x,y (RCL) 2 SUM (STO) 4 CI 3 SUM (STO)

Clears 4

Entered variables can be corrected with the INV and DLT (STO) keys after the SUM (STO) key is depressed.

(Ex.) 1 SUM (STO) 2 SUM (STO) 3 SUM (STO) 3 INV DLT (STO)

Clears 3

(Ex.) 1 SUM (STO) 3 SUM (STO) 2 SUM (STO) 4 SUM (STO) 3 INV DLT (STO)

Clears 3

1-4 Entry of Variable with Frequency

(Ex. 2) Calculate the sum (Σx), square sum (Σx^2), number (n), mean value ($\bar{x}$), standard deviation sample ($x\sigma^{n-1}$), and standard deviation population parameter ($x\sigma^n$) from the variables with the frequencies listed in the table.

x	2.5	7.5	12.5	17.5	22.5
f	3	7	9	6	2

Operation	Display	Explanation
MODE (4)	0.	Specifies one-variable statistical mode
INV CA (ON/C)	0.	Clears the storage memory
INV FIX (FSE) (4)	0.0000	Specifies decimal point selection at 4 digits.
2.5 (×) 3 SUM (STO)	3.0000	Entry of variables * Variable numbers are displayed
7.5 (×) 7 SUM (STO)	10.0000	
12.5 (×) 9 SUM (STO)	19.0000	
17.5 (×) 6 SUM (STO)	25.0000	
22.5 (×) 2 SUM (STO)	27.0000	
INV Σx (1)	322.5000	Σx
INV Σx^2 (2)	4668.7500	Σx^2
INV n (3)	27.0000	n
INV $\bar{x}$ (()	11.9444	$\bar{x}$
INV $x\sigma^n$ (−)	5.4997	$x\sigma^n$
INV $x\sigma^{n-1}$ (+)	5.6045	$x\sigma^{n-1}$

2. Two-Variable Statistical Calculations

(Ex. 1) Calculate the mean value ($\bar{x}, \bar{y}$), standard deviation sample ($x\sigma^{n-1}$, $y\sigma^{n-1}$), correlation coefficient (r), and intercept (a) and gradient (b) at the regression line from following weights (x) and heights (y). Then estimate the height (y) of the people whose weights are 40 kg, and the weight (x) of the people whose heights are 180 cm.

	A	B	C	D	E	F	G
Weight(x) kg	55	55	50	65	68	40	?
Height(y) cm	162	175	160	172	177	?	180

2-1 Entry of Variables

Operations	Display	Explanations
MODE (5)	0.	Specifies the two-variable statistical mode
INV CA (ON/C)	0.	Clears the storage memory
INV FIX (FSE) (4)	0.0000	Specifies decimal point selection at 4 digits
55 x,y (RCL)	55.0000	Entry of variable (x)
162 SUM (STO)	1.0000	Entry of variable (y)
60 x,y (RCL) 175 SUM (STO)	2.0000	Entry of variables * Variable numbers are displayed
50 x,y (RCL) 160 SUM (STO)	3.0000	
65 x,y (RCL) 172 SUM (STO)	4.0000	
68 x,y (RCL) 177 SUM (STO)	5.0000	

2-2 Output of Statistics

Operation	Display	Explanation
INV $\bar{x}$	59.6000	$\bar{x}$
INV $\bar{y}$	169.2000	$\bar{y}$
INV $x\sigma^{n-1}$ (+)	7.3007	$x\sigma^{n-1}$
INV $y\sigma^{n-1}$ (×)	7.7266	$y\sigma^{n-1}$
INV r (9)	0.9059	r
INV a (7)	112.0600	a
INV b (8)	0.9587	b
40 INV $\hat{y}$ (−)	150.4090	Estimate y (y)
180 INV $\hat{x}$ (0)	70.8650	Estimate x (x)

2-3 Correction of Variables

Entered variables can be corrected with the CI key before depressing the x,y (RCL) or SUM (STO) key.

(Ex.) 1 x,y (RCL) 2 SUM (STO) 4 CI 3 x,y (RCL) 4 SUM (STO)

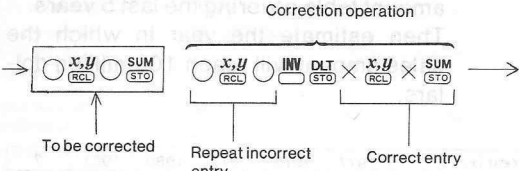
↑ Clears 4

After the x,y (RCL) key has been depressed, entered variables can be corrected by entering the correct value and depressing the x,y (RCL) key.

(Ex.) 1 x,y (RCL) 2 SUM (STO) 4 x,y (RCL) 3 x,y (RCL) 4 SUM (STO)

↑ Corrects 4

Variables entered with the SUM (STO) key is can be corrected by following operation.


Correction operation
x,y (RCL) SUM (STO)
x,y (RCL) INV DLT (STO) × x,y (RCL) × SUM (STO)
To be corrected
Repeat incorrect entry
Correct entry

(Ex.) 1 x,y (RCL) 2 x,y (RCL) 4 x,y (RCL) 4 SUM (STO) 4 x,y (RCL) 4 INV DLT (STO)

Correct 4

3 x,y (RCL) 4 DLT (STO)

(Ex. 2) Calculate the intercept (a) and gradient (b) of regression line ($y=a+bx$) and correlation coefficient (r) from the sales amount table covering the last 5 years. Then estimate the year in which the sales amount will reach 100 million dollars.

Year (x)	1977	1978	1979	1980	1981	?
Sales amount (y) (million dollars)	11.9	22.4	25.4	29.4	36.0	100

* The sales amounts are entered in common logarithm.

Operation	Display	Explanation
MODE 5	0.	Specifies two-variable statistical mode
INV CA (ON/C)	0.	Clears the storage memory
INV FIX (F.S.E) 4	0.0000	Specifies decimal point selection at 4 digits.
1977 x,y (RCL) 11.9 INV log (ln) SUM (STO)	1.0000	Entry of variables
1978 x,y (RCL) 22.4 INV log (ln) SUM (STO)	2.0000	
1979 x,y (RCL) 25.4 INV log (ln) SUM (STO)	3.0000	
1980 x,y (RCL) 29.4 INV log (ln) SUM (STO)	4.0000	
1981 x,y (RCL) 36.0 INV log (ln) SUM (STO)	5.0000	
INV r (9)	0.9373	r
INV a (7)	−212.2838	a
INV b (8)	0.1080	b
100 INV log (10^x) INV x̂ (0)	1984.8257	In 1984, the sales amount will reach 100 million dollars.

3. Statistical Expressions

Outputs	Operation	Expression
Sum of variables (x)	INV Σx (1)	Σx
Square sum of variables (x)	INV Σx² (2)	Σx^2
Number of variables	INV n (3)	n
Mean value of variables (x)	INV $\bar{x}$ (4)	$\bar{x}=\frac{\Sigma x}{n}$
Standard deviation sample of variables (x) Standard deviation	INV $x\sigma n{-}1$ (+)	$\sqrt{\frac{\Sigma x^2-\frac{(\Sigma x)^2}{n}}{n-1}}$
Population parameter of variables (x)	INV $x\sigma n$ (−)	$\sqrt{\frac{\Sigma x^2-\frac{(\Sigma x)^2}{n}}{n}}$
Sum of variables (y)	INV Σy (4)	Σy
Square sum of variables (y)	INV Σy² (5)	Σy^2
Mean value of variables (y)	INV $\bar{y}$ (6)	$y=\frac{\Sigma y}{n}$
Standard deviation sample of variables (y) Standard deviation	INV $y\sigma n{-}1$ (×)	$\sqrt{\frac{\Sigma y^2-\frac{(\Sigma y)^2}{n}}{n-1}}$
Population parameter of variables (y)	INV $y\sigma n$ (÷)	$\sqrt{\frac{\Sigma y^2-\frac{(\Sigma y)^2}{n}}{n}}$
Sum of product of variables (x, y)	INV Σxy (6)	$\Sigma x\cdot y$
Intercept(a) of regression line	INV b (8)	$\frac{n\cdot\Sigma xy-\Sigma x\cdot\Sigma y}{n\cdot\Sigma x^2-(\Sigma x)^2}$
Gradient (b) of regression line	INV a (7)	$\frac{\Sigma y-b\cdot\Sigma x}{n}$
Correlation coefficient (r)	INV r (9)	$\frac{n\cdot\Sigma xy-\Sigma x\cdot\Sigma y}{\sqrt{\lvert n\cdot\Sigma x^2-(\Sigma x)^2\rvert\cdot\lvert n\cdot\Sigma y^2-(\Sigma y)^2\rvert}}$
Estimate (x)	Y INV x̂ (0)	$\hat{x}=\frac{Y-a}{b}$
Estimate (y)	X INV ŷ (.)	$\hat{y}=a+bx$

IV. Programmed Calculations

A sequential key operation can be entered in the program memory as a program and then executed to perform the entered operation automatically. Five program instructions, "ENT", "HLT", "$x > 0$", "$x \leqq M$", and "GOTO", control the program procedures.

Program 1, Program 2: Two programs can be stored in the program memory at the same time. These are entered (program entry) in the LRN1 and LRN2 modes. The program entered in the LRN1 mode is called program 1. The program entered in the LRN2 mode is called program 2.

These programs are executed in the DEC mode. Use the [RUN] key for program 1 execution and the [INV] and [RUN] keys for program 2.

Step: Each key operation in a program is called a step. Each keystroke is considered one step except when more than one keystroke is required to register an operation ([INV] [π], [HYP] [sin] , etc).

[STO] [n] and [RCL] [n] are both considered 2 program steps. Up to 45 program steps can be stored and executed. If two programs are stored, the total number of steps for both programs cannot exceed 45 steps.

HLT, ENT Instructions:

- HALT instruction --- Halts the program execution.

When this program instruction is executed during the program flow, execution stops. Execution is restarted by depressing the [RUN] key (program 1) or the [INV] and [RUN] keys (program 2). This instruction is also used to display a value during calculation. When this program instruction is entered in the LRN1 or LRN2 mode or is used to stop program execution in the DEC mode, "HLT" is displayed.

(Ex.)

Program	
3	
+	
4	
=	
HLT	← Program execution stops at this step, and 7 is displayed. Depressing [RUN] (program 1) or [INV] [RUN] (program 2) restarts the program and the remaining steps are executed.
×	
2	
=	

- ENT Instruction --- Used for entering values during program execution. When this program instruction is executed during the program flow, program execution stops and numbers can be entered.

  Use the same procedure to restart program execution as that used for the HALT instruction.

When the program is entered, the steps where this program instruction is placed are automatically numbered as variables (01 to 45). These numbers are displayed as entry requests when the program is executed.

*Program steps entered are executed one after another during programming. Therefore it is necessary to enter dummy data immediately after each ENT instruction to check the program procedure and confirm the resulting calculation.

When dummy data input is omitted during program entry, the default value 0 is entered automatically. If a division calculation routine, like A÷B, is programmed and dummy data is omitted, the calculation 0÷0 is executed and an error occurs.

Entry of dummy data is not counted as a program step.

(Ex.) When programming the calculation 5×A÷B

Program

```
5
×
ENT←┐ When the program is entered,
÷   │ these steps are numbered as
ENT←┘ variables 01 and 02.
=     When the program is executed,
      numeric entry is required when
      these variable numbers are
      displayed.
```

The Entry procedure is as follows:

Step	Entry Operation	Explanation
	MODE □	Specifies the LRN 1 mode
1	5	Constant
2	×	
3	ENT	
	2	Dummy data
4	÷	
5	ENT	
	4	Dummy data
6	=	

5×2÷4=2.5 is executed during the entry operation.

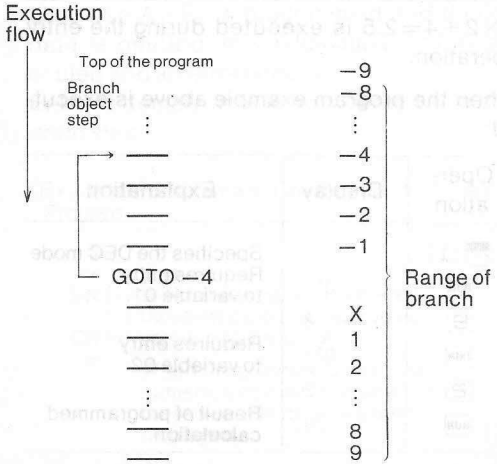
When the program example above is executed:

Operation	Display	Explanation
MODE 1		Specifies the DEC mode
RUN	−01−	Requires entry to variable 01.
8	8.	
RUN	−02−	Requires entry to variable 02.
2	2.	
RUN	20.	Result of programmed calculation

In this example, 5×8÷2=20 is performed.

Branch Instructions: Usually the program is executed from the first step to the last in sequence. Branch instructions change the execution flow and this process is called branching. There is one unconditional branch instruction, "GOTO", and two conditional branch instructions, "$x > 0$" and "$x \leqq M$". A branch object step is the step where program execution jumps when the branch instruction is executed.

The branch object step can be the first program step (the top of the program) or any program step within the 9 steps preceding or the 10 steps following the branch instruction.



- GOTO Instruction --- Used to branch the program to a specified step.

  Specify this instruction in format GOTO n ($-9 \leqq n \leqq 9$) as shown below:

	Entry Operation
$n = 0$ or $1 \leqq n \leqq 9$	INV GOTO 1 (···9)
$-9 \leqq n \leqq -1$	INV GOTO +/− 1 (···9)

* These operations are regarded as 1 program step.

(Ex.)

Step	Program
1	ENT
→2	SM
3	×
4	RM
5	=
6	HLT
7	GOTO −5 ←

Program flow branches to step 2 when the GOTO instruction is executed. Steps 2−7 are then repeated. Depress the %c key to end program execution.

- $x>0$, $x\leqq M$ Instructions --- Used to the branch the program execution to a specified step depending on the displayed value or the contents of the independent memory.
The $x>0$ instruction branches the program when the displayed value is greater than 0.
The $x\leqq M$ instruction branches the program when the displayed value is equal to or less than the value of the independent memory contents.
Specifying the branch object step is the same as that described for the GOTO instruction.

(Ex.)

Step	Program	
1	ENT	
2	−	
3	ENT	
4	=	
5	$x>0$ 1 ←	When the result of subtraction is less than 0, the result's square root is calculated after the sign is changed.
6	+/−	
7	√	

(Ex.1) Create a program to calculate the surface area ($S=4\pi r^2$) and volume ($V=4\pi r^3/3$) of a sphere by entering its radius (Y).
The relationship among r, S, and V is:
$4\pi r^2=S$, $S\times r/3=V$
First calculate S and then display the result using the HLT instruction.

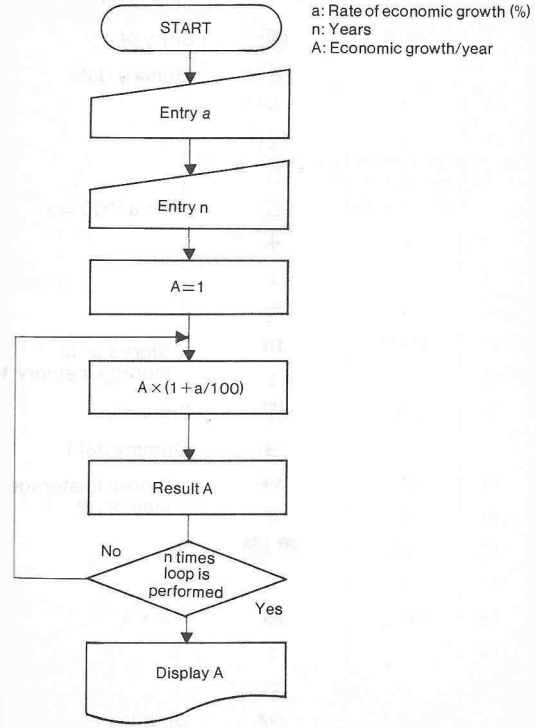
Step	Program	Entry Operation	Explanation
		MODE □	Specifies the LRN1 mode
1	4	4	
2	×	×	
3	π	INV π (EXP)	
4	×	×	
5	ENT	ENT (⇨)	Variable for r
		1 □	Dummy data
6	SM	SM	Stores the value of r in the independent memory
7	x^2	x^2	
8	=	=	
9	HLT	HLT (RUN)	Displays the value of S
10	×	×	
11	RM	INV RM (M+)	Reads the value of r from the independent memory
12	÷	÷	
13	3	3	
14	=	=	

When this program is executed:

Operation	Display	Explanation
MODE 1		Specifies the DEC mode
RUN	−01−	Executes program. Requires entry of value of r.
2 0	20.	r=20
RUN	5026.548246	The value of S (r=20)
RUN	33510.32164	The value of V (r=20)
RUN	−01−	Restarts the program from the top
9 · 8	9.8	r=9.8
RUN	1206.874234	The value of S (r=9.8)
RUN	3942.45583	The value of V (r=9.8)

(Ex.2) Create a program to calculate the growth of the economy in n years using the value n (years) and *a*% (the rate of economic growth).

When a program loop is used instead of x^n, the program flow is as shown below:



The program and its entry procedure are as follows:

Step	Program	Entry Operation	Explanation
		MODE □	Specifies the LRN1 mode
1	1	1	Initial value of A
2	SM	SM	Stores to independent memory
3	ENT	ENT	Entry of *a*
		2	Dummy data
4	÷	÷	1+a/100=*a'*
5	1	1	
6	0	0	
7	0	0	
8	+	+	
9	1	1	
10	=	=	
11	STO	STO	Stores *a'* to storage memory 1
12	1	1	
13	ENT	ENT	Entry of n
		3	Dummy data
14	STO	STO	Stores to storage memory 2
15	2	2	
16	RM	INV RM (M+)	A x *a'*
17	×	×	
18	RCL	RCL	
19	1	1	
20	=	=	
21	SM	SM	Updates A
22	GOTO 1	INV GOTO (9) 1	Branches the program to the count routine (step 24)
23	GOTO−7	INV GOTO (9) (+) 7	Branches the program to the calculation routine (step 16)
24	RCL	RCL	n-1
25	2	2	
26	−	−	
27	1	1	
28	=	=	
29	STO	STO	
30	2	2	
31	$x>0-8$	INV x>0 (7) (+) 8	Checks counter Displays the calculation result
32	RM	INV RM (M+)	

In the program example, the values of a and n are entered and the value of a is converted to the required form, and then they are all stored to the memories.

Steps 16 - 21 are the calculation routine. The economic growth for the year is calculated by executing this routine.

Steps 24 - 31 are the count routine. This routine subtracts 1 from n by executing the loop once. When the value of n is 0, program execution branches out of the loop and the calculation result is displayed.

The values in the memories are as follows:

	Independent Memory	Storage Memory 1	Storage Memory 2
Initial Value	1	$1+a/100$	n
After the loop is executed once	$1\times(1+a/100)$,	$n-1$	
	$1+a/100$	$1+a/100$	$n-1$
$(n-1)-1$ After the loop is executed twice	$(1+a/100)(1+a/100)$,	$(n-1)-1$	
	$(1+a/100)^2$	$1+a/100$	$n-2$
	⋮		
After the loop is executed n times	$(1+a/100)^n$	$1+a/100$	0
Program ends			

Specifications

Display Range:

Exponential Type ..... Mantissa, 8 digits + exponent, 2 digits + sign, 2 digits

Floating Type ..... Mantissa, 10 digits + sign, 1 digit

Display Type: Floating, Scientific Exponential (SCI), Engineering Exponential (ENG)

Calculation Range:

Decimal ..... $\pm 1\times10^{-99}$ to $\pm 9.999999999\times10^{99}$

Hexadecimal ..... 7FFFFFFFF to 0 to 8000000001

Octal ..... 3777777777 to 0 to 4000000001

Negative Value:

Decimal... True value with minus sign

Hexadecimal/Octal... Two's compliment

Decimal Point Specification: Decimal position can be specified from 0 to 7 digits

Types of Calculation: Addition, subtraction, multiplication, and division. Chain multiplication and division. Repeat addition and subtraction. Addition, subtraction, multiplication, and division by a constant. Percentage calculation. Increase ratio calculation. Parentheses calculation. Memory calculation. Hexadecimal calculation. Octal calculation. Hexadecimal/octal/decimal conversion. Mixed calculation.

Functions: Trigonometric. Inverse trigonometric. Logarithmic. Exponential. Hyperbolic. In-

verse hyperbolic. Decimal and sexagecimal conversion. Polar and rectangular coordinate conversion. Multiple roots. Powers. Extraction of cubic root. Extraction of square root. Square. Inverse number. Factorial. Constant (π).

Metric Conversions: lb⇄Kg, in.⇄cm, gal⇄ℓ, and °F⇄°C.

Statistical calculations: Number of variables (n). Sum (Σx, Σy). Square sum (Σx^2, Σy^2). Sum of products (Σxy). Mean value ($\bar{x}$, $\bar{y}$). Sample standard deviation (σx^{n-1}, σy^{n-1}). Population standard deviation (σx^n, σy^n) of one variable (x) or two variables (x, y).
Intercept (a), gradient (b), correlation coefficien (r), and estimate ($\bar{x}$, $\bar{y}$) of regression line ($y=ax+b$).

Programmed Calculation: Two programs of up to 45 steps can be executed. ENT, HLT, GOTO, $x>0$, and $x\leqq M$ program instructions.

Processor: CMOS-LSI

Power Source: DC 3V, 0.36mW
Silver oxide battery (G-13) × 2
Approx. 4,000 hours of operation
Alkaline battery (LR44 or A76) × 2
Approx. 1,500 hours of operation

Size: 70mm(W) × 137mm(L) × 8mm(H)
(2-3/4″ × 5-13/32″ × 5/16″)

Weight: 75g (2.6 oz.) with batteries

Subject to change without notice.